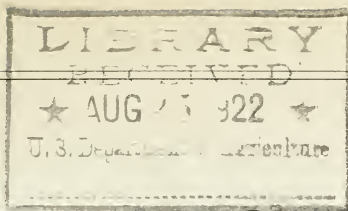


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WILD RICE

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THE PRINCIPAL USE of wild rice is as food for wild ducks and other waterfowl. Wild rice is also used to a limited extent as human food, particularly by some of the Indian tribes of the upper Mississippi Valley.

Wild rice grows in shallow lakes and on marshy lands bordering tidal rivers above brackish water, where the streams are sluggish. Under these conditions, where it can anchor itself in a thick layer of mud, regardless of the kind of soil, the plant seems to make its best growth.

Because it attracts ducks and other game birds, wild rice often is sown on hunting preserves, but the results frequently are unsatisfactory because the seed does not germinate well.

To insure good germination the seed must be kept moist from the time it is harvested until it is sown and must be stored at a low temperature.

In the vicinity of Washington, D. C., the seed should be sown broadcast about the middle of April at the rate of a handful of well-matured seed to 2 square yards of water surface.

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CHARLES E. CHAMBLISS, *Agronomist in Charge of Rice Investigations, Office of Cereal Investigations, Bureau of Plant Industry.*

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WILD RICE IN NATURE.

WILD RICE (*Zizania aquatica* L.; *Z. palustris* L.) is a tall annual grass, distantly related to the cultivated rice. It is a favorite food of ducks, geese, and other game birds and may be successfully grown on or near shooting grounds in many localities where it does not now occur if proper attention is given to the conditions which the plant requires for healthful growth. East of the Rocky Mountains many old patches are disappearing which can and should be preserved as feeding grounds for wild fowl, particularly wild ducks. The purpose of this bulletin is to answer many questions that are asked about this aquatic plant and to arouse interest in providing means for attracting game birds and supplying them in season with one of their favorite foods.

In the northern part of the United States this plant is known by such names as Canadian rice, Indian rice, wild rice, squaw rice, riz du Canada, and menomen, while in the South Atlantic States it is more commonly called water oats, marsh oats, and wild rice.

CONDITIONS UNDER WHICH WILD RICE GROWS.

Wild rice is a fresh-water plant and will not grow successfully in water that is appreciably salty to the taste. It makes its best growth in shallow lakes and on mud flats and low marshland bordering tidal

rivers above brackish water, where under normal conditions the streams are sluggish.

In the Northern States the growth of the plant often is seriously affected when the depth of water in the old patches is increased in spring and held at a high level for a long time. When the change of water level is more than 2 or 3 feet there usually is no growth of wild rice during that season. This does not necessarily mean that the patch is destroyed, for as a rule there is a thin stand the following spring if water conditions are favorable, the plants being produced from seed that apparently have remained dormant for at least 20 months.

The daily and regular change of water level which occurs in tidal streams does not affect the growth of wild rice injuriously. Large

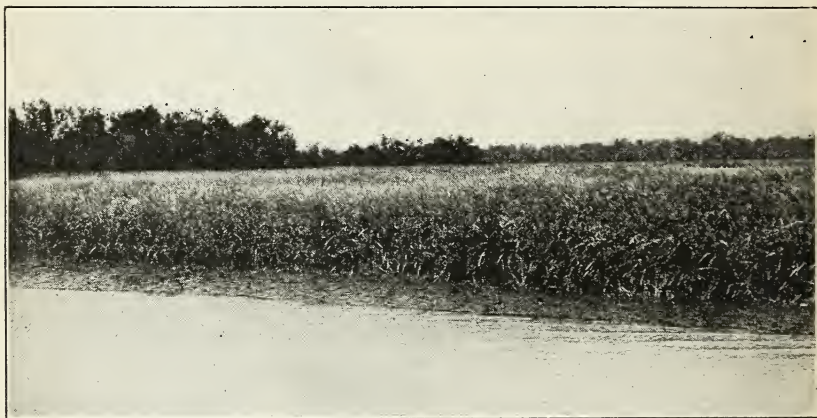


FIG. 1.—A typical wild-rice marsh in Virginia.

patches of this grass cover many acres on the Potomac River flats that are often exposed at low tide and submerged at high tide to a depth of approximately 3 feet. The submergence of these flats for a long time during early spring, however, may so affect the general vigor of the plants as greatly to reduce the production of seed.

Wild rice grows well on a variety of soils under fresh-water streams and lakes, but it seems to make its best growth wherever the plants can anchor themselves in a thick layer of mud, regardless of the kind of soil.

WHERE WILD RICE GROWS.

The natural range of wild rice in North America extends southward from the northern end of Lake Winnipeg to the Gulf of Mexico and eastward to the Atlantic coast throughout these latitudes. In the northern part of this region it grows mainly in shallow lakes and sluggish streams, while in the eastern and southern part of the United States it thrives above brackish water in low marshes (Fig. 1) bordering most of the tidal rivers emptying into the Atlantic Ocean.

DESCRIPTION OF THE PLANT.

The wild-rice plant is an aquatic annual grass having tall, erect, cylindrical, and hollow stems which bear long leaves with flat blades conspicuously marked by a very thick midrib. The principal roots are slender and fibrous and do not penetrate deeply into the soil.

The stem has a comparatively thin wall and is exceedingly slender. It ranges in height from 7 to 11 feet and in diameter from a quarter to five-eighths of an inch. In thin sands and among isolated plants a single plant may have more than one stem, the additional ones usually arising from the base of the main stem, though sometimes as branches above this point.

The first leaves to appear are long and narrow. They float upon the surface of the water, but wither and die when the plant is stout enough to stand erect. The sheath, or that part of the leaf which completely wraps the stem, varies in length from 9 to 25 inches. The blade, which is flat and very broad in the plants on the Potomac River, may measure from 9 to 48 inches in length. The leaves remain green until after the seeds ripen.

The flower cluster consists of two parts, an upper, having erect branches bearing the female or seed-producing flowers, and a lower, with drooping branches bearing the male flowers.

The two protecting glumes, or chaff, of the female flower enclose a much-branched stigma and a comparatively small ovary. The outer and larger glume bears a long awn or beard. The female flowers emerge first and open before the male flowers of the same plant get out of the leaf sheath. In this way nature provides for cross-fertilization.

The envelope of the male flower also consists of two glumes, which inclose six bright-yellow stamens that, soon after their release, discharge their pollen to be carried by the wind to the stigmas of nearby plants.

The seed (Fig. 2) is long and slender and almost cylindrical in shape. Its thin brown hull, which adheres tightly to the kernel, bears a long, stiff, twisted awn, on which there are numerous barbs or bristly hairs pointed upward. The surface of the hull itself has short, stiff bristles that point in the same direction. These structures probably help to bury the seed in the mud.

The kernel (Fig. 3) is one-half to three-quarters of an inch in length, has a shallow groove extending the length of one surface, and when fully matured is purplish black in color.

KINDS OF WILD RICE.

Two species of plants are commonly known as wild rice. One of them (*Zizania aquatica* L.) has narrow leaves; rather short, compact flower clusters averaging about 16 inches in length (Fig. 4); and stems that seldom exceed 8 feet in height. It also is often distin-

guished by purple male and female flowers with leaf markings of the same color. The other species (*Z. palustris* L.) has broad leaves; rather long, loose flower clusters, varying in length from 15 to 29



FIG. 2.—Seeds of wild rice of the broad-leaved species. (Natural size.)

inches (Fig. 5), and stems that range in height from 7 to 11 feet. Purple flowers and leaves are not characteristic of this species, though individual plants often are so marked.

The first species is found mainly in the northern part of the United States and in Ontario, Canada; the second in the eastern and south-



FIG. 3.—Kernels of wild rice of the broad-leaved species. (Natural size.)

ern part of the United States. The seeds of the southern species, with broad leaves, average 1 inch in length, not including the awn, and one-sixteenth of an inch in width. The seed of the other species is shorter and broader.

Extreme variations are found in the narrow-leaved species. In eastern Canada mature plants are found that measure only 6 to 10 inches in height, the tallest averaging about 3 feet. The seed that is produced by these plants is small and has a short awn or none at all. There also are several forms of the broad-leaved species.

Some of the differences may be due to soil and climatic conditions, but there are forms with structural differences that are not characteristic of the two recognized species which are worthy of study. Possibly these forms are more productive than those from which our supply of seed is now obtained. It is quite likely, too, that some of them do not shatter their grain upon maturity. Forms possessing this character alone without increased production would make the growing of wild rice a profitable business for many seedsmen.

GROWING WILD RICE.

WHERE TO SOW.

Wild rice grows luxuriantly above brackish water on mud flats that are submerged by the tides. If any great deposit of silt is thrown down at the mouths of creeks flowing into the tidal rivers, such places also furnish favorable conditions for its growth. Occasionally a good stand of wild rice is found on sand bars that are submerged by the tide. In shallow bays that are connected with the main stream this plant is often found growing almost to the exclusion of any other species.

In the northern part of the Mississippi Valley and in Canada, away from tidal streams, wild rice grows in large, narrow patches on the margins of lakes and streams and sometimes covers large areas in the shallow lakes of these regions.

There are many localities having these conditions in which wild rice is not found that may be used successfully for its propagation. Good results are likely to be obtained if the planting is made where the soil is soft and mucklike or covered with a thick layer of mud. The submerging water should be fresh and not stagnant, but should not have a noticeable current under normal conditions.



FIG. 4.—A flower cluster (botanically called a panicle) of wild rice which is typical of the narrow-leaved species. Its natural length is $16\frac{1}{2}$ inches.

Although wild rice naturally grows upon sand bars and silt deposits at the mouths of creeks, the plant should not be sown upon them, for they often are destroyed by strong currents.

WHEN TO SOW.

It is a common practice in many localities to sow wild rice in autumn soon after the seed has been gathered. This is wasteful and expensive, for seed sown at this time is likely to be eaten in large quantities by ducks and other birds in autumn and early spring, resulting in poor stands if any are obtained. If not devoured by waterfowl the seed may be covered so deeply with the mud deposited by spring freshets that after germination the greater percentage of the young plants die before they can reach the surface.

For these reasons spring seeding is recommended. April 15 is the approximate date for seeding wild rice in the vicinity of Washington, D. C. However, seeding in this locality as late as May 12 has produced plants that ripened seed as early as the plants that developed from the self-sown or shattered seed.

HOW TO SEED.

Germinable seed is not always obtainable, because many seedsmen do not know what should be done with the gathered grain to maintain its vitality and therefore are not properly equipped to handle it. The common mistake is to store wild-rice seed under dry conditions. When kept in dry storage, like other seeds, it soon dies.

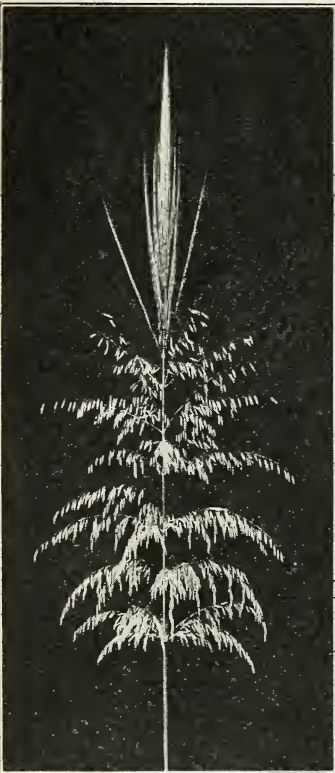


FIG. 5.—A flower cluster (botanically called a panicle) of wild rice which is typical of the broad-leaved species. Its natural length is 26 inches.

More failures in the introduction of wild rice into new localities are due to the use of such seed than to any other cause.

Wild-rice seed should be purchased only from seedsmen who will guarantee that the seed has been properly stored and well graded and will further agree to ship it under conditions that will protect its vitality while in transit. Considering the high price of this seed, such a demand is not unreasonable.

In sowing wild rice it is just as important to use ripe and well-graded seed as in sowing cultivated crops. Seed mixed with a large percentage of immature seed, which is often found on the market, should not be used, as it invariably will produce a poor stand.

The ripe seed, which is brown in color, when sown will sink into the water at once by its own weight. In sowing on tidal land the seed should be broadcasted from a rowboat or canoe on a rising tide when the water is about a foot deep. This will keep the seed from drifting into deeper water, and before the tide ebbs it will be so firmly embedded in the soft mud that none of the seed will be moved outward by the retreating water.

A good stand may be obtained if the seed is used promptly after removal from cold storage and is evenly scattered at the rate of a handful of well-matured seed to 2 square yards of water surface. The plants of a thin stand are usually not sufficiently self-supporting against winds to develop a strong growth and are also likely to tiller and branch entirely too much to mature evenly. This lack of uniformity in ripening is a disadvantage if the seed is to be harvested, but if the plants are grown to attract ducks the long period of ripening may be a decided advantage in reseeding and maintaining the patch.

When sown for the first time in a new locality, a heavier seeding is advisable, to provide for losses which are likely to occur from the feeding of wild ducks.

The shallow lakes and margins of the interior rivers should be sown in the same manner. Care should be taken, however, not to seed in water more than 2 feet deep. A lesser depth of water is desirable, because the young plants grow more vigorously in shallow water.

TRANSPLANTING.

New patches of wild rice may be readily established by transplanting the young plants. To get good germination, these should be grown on a seed bed (Fig. 6) that has been plowed or spaded to a depth of approximately 6 inches. The soil should be worked down immediately to a rather smooth surface with a harrow or other implement. The seed bed is then ready to be inclosed by levees or banks and submerged with water. Before seeding, the bed should be covered with water to a depth of 6 inches. This depth must be maintained until the young plants are removed. The seed should be sown broadcast upon the water at the rate of a handful of well-matured seed to a square yard of water surface. Viable seed sown at this rate will give the thick stand that is needed to get the maximum number of plants in a bed.

The plants may be removed for transplanting when they are 12 to 15 inches high. They are strong enough at this age to stand a reason-

able amount of rough handling, but care should be taken not to bend sharply or to crush the plant just above the crown. Under no circumstances should they be allowed to become dry.

The soil into which they are to be set should be deeply prepared, so that it will become very soft and muddy and remain so when submerged. This result is easily obtained on loamy soils; clay soils are not so satisfactory.

The plants should be set singly about a foot apart in shallow holes made by the hand or with a blunt stick. The roots should be spread apart and the soil pressed firmly upon them and around the plant at

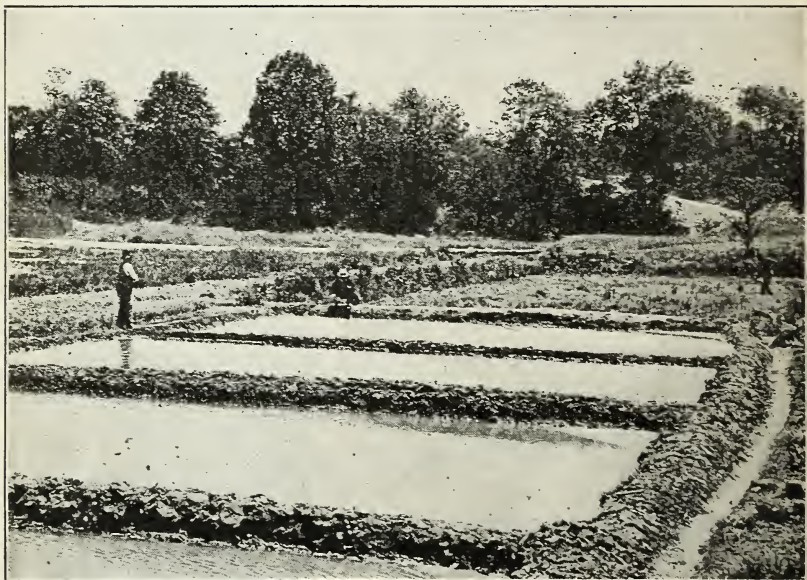


FIG. 6.—A general view of plats used at the Arlington Experimental Farm, Va., for the growing of wild rice. Plats of this character are well adapted to the growing of seedlings for transplanting.

the crown. After new roots have developed the plants soon become erect, and in a short time new leaves appear.

At the time of transplanting there should be at least 8 inches of water upon the land. This depth of water will provide the conditions required by the plants and also serve to support them until they are strong enough to stand erect. After this, the water, if controllable, should be not less than 6 inches deep. If the land upon which they are to be grown is exposed to the rise and fall of the tide, no attempt should be made to regulate the depth of the water.

SEASONAL GROWTH.

On the mud flats of the Potomac River in the vicinity of Washington, D. C., wild rice often germinates as early as the latter part of March, but the highest percentage of germination usually occurs about the middle of April. The young plant grows slowly. It is often 3 weeks old before it is strong enough and sufficiently anchored

to stand erect. This may be due in part to the effect of the changing water level that occurs daily on tidal land, for when grown in shallow water kept at a uniform depth the young plant becomes erect within 10 to 13 days. During its early growth the foliage of the plant floats in or upon the surface of the water at high tide. At low tide the entire plant lies flat upon the mud. There is a rapid and vigorous leaf development (Fig. 7) in the healthy plant after the first month's growth. The foliage becomes erect, with drooping tips, and the plant often obtains a height of 5 feet before the flower cluster appears.



FIG. 7.—An almost perfect stand of wild rice, about 45 days old, growing in a marsh near Washington, D. C. A few plants of pickerel weed are seen near the center of the picture.

Under normal weather conditions the flower clusters (Fig. 8) emerge within 80 days after germination. The seeds usually begin to ripen about 30 days later. The ripening of the seeds in a single flower cluster is seldom completed within a week. The period of ripening in any given area of wild rice may extend over three weeks.

In the vicinity of Washington, D. C., the plants that emerge about the middle of April ripen some seed as early as August 15. While this period of growth varies with the seasons, there is always ripe or ripening seed in abundance in the early part of September. The seed does not remain attached very long after maturity and may drop from the plant before the kernel becomes hard.

PROPAGATION.

Keepers of hunting preserves and superintendents of gun clubs should not depend upon the natural reseeding of wild rice for the preservation of the patches under their control. The seed produc-

tion of this plant under normal conditions usually is large enough to supply sufficient food for the game birds and to provide for the next year's crop. This remainder may be seriously affected, however, by an unusually large invasion of birds, which, of course, means a greater



FIG. 8.—Typical plants of the broad-leaved species of wild rice in flower at the Arlington Experimental Farm, Va., August 14, 1916.

consumption of seed and possibly the destruction of the natural seed bed in those sections where feeding extends throughout the greater part of the winter. There is also a possibility of having the young growth seriously damaged by deposits of silt and various kinds of débris which are often left by spring freshets.

It is important, therefore, that the seeding or transplanting of wild rice should be done on hunting reservations in early May whenever there are indications in spring of a poor stand. It is the only way to maintain a growth that will furnish food for the birds and seed for crop production. Facilities for storing the seed and growing the seedlings of wild rice should be a part of the equipment of every hunting club that is located where this plant will grow.

The new patches which are made by transplanting are not likely to be large, because of the labor that is required to set out the plants. On account of their small size they must be protected, or the greater part of the seed produced on them will be consumed by the ducks during the first winter. The most effective method would be to remove the surface water from the land each year after the seed has fallen until the patch has become sufficiently large to supply food for these birds without lessening the chances of a good stand for the following season. Almost perfect stands of wild rice have been obtained on plats at the Arlington Experimental Farm, Va., that were kept free of surface water during the winter.

HOW TO HARVEST.

The Indians of Minnesota, Wisconsin, and Canada, who use the seed of wild rice for food, harvest the grain in a very primitive way. They go among the plants in birch-bark canoes or small flatboats, and from these they gather the seed. The method is simple, though patience and skill are required to get maximum results. The stalks of the plants are bent over the boat, care being taken not to break them, and with light blows from sticks the grain is knocked into the boat. The fully matured seeds fall at the slightest touch, and many are lost by dropping into the water instead of the boat. Unless the plants are roughly handled the green seeds do not drop and may be gathered later. On account of the lack of uniformity in ripening, the harvest period may extend over several weeks.

For centuries these Indians have been gathering this food in this way. The white man with all his ingenuity resorts to this same method and will continue to do so until the plant is brought under cultivation. The use of machinery to harvest this crop is desirable from the standpoint of saving time and labor, but it is hardly probable that any mechanical device can be handled skillfully enough to gather this seed with less loss than can be done by hand. Growing as a wild plant, it will continue to shatter its seed at maturity. This habit alone makes it difficult to gather as much as 50 per cent of the seed produced.

The seed should be spread out to dry as soon as it is gathered. In doing this, however, it must not be exposed to the sun. Under ordinary circumstances the seed may be sufficiently dried by turning it over several times during the first day after harvest. After it has been cleaned with a fan or by other means, the seed should be shipped

or stored without any delay if a high percentage of germination is to be obtained.

STORAGE OF SEED.

The seed of wild rice drops at maturity into the soft mud upon which the plant is growing and remains there during the winter without loss of vitality. Unless the buried seed is eaten by birds or other animals or is covered too deeply with mud, a good stand of rice invariably follows a season of good production. It has been determined by experiments that it is absolutely necessary to keep the seed moist and at a low temperature if its vitality is to be preserved.

Therefore, the safest method is to put the seed in cold storage in a wet state or to store it outdoors under conditions that will keep it wet and at a temperature which will prevent fermentation. The first method probably will be preferable to seedsmen who obtain their seed supply from a distance, if cold-storage space can be cheaply rented. When this method is used the seed should be put in uncovered receptacles and placed in a room at the temperature of 32° to 34° F.



FIG. 9.—A galvanized-iron can which has been used at the Arlington Experimental Farm, Va., for the storage of wild-rice seed. It was filled and securely fastened at the bottom of the stream on September 15 and removed on May 1.

The outdoor method, however, can be used effectively and cheaply by those who are located near the source of the seed supply. This method has been successfully used at the Arlington Experimental Farm, Va., and provides for storage in large receptacles that are securely anchored at the bottom of the stream in which the plant grows. If a small quantity is to be stored, the seed may be put in

galvanized-iron cans (Fig. 9) such as are used for garbage. The cans should be perforated on the side and top, the holes being numerous enough to provide for water circulation, but small enough to prevent the escape of the seed. In filling the container the seed should not be packed too tightly or fermentation may occur. The can should be promptly submerged as soon as it is filled and should be securely fastened to the bottom of the stream in a vertical position where it will be covered by at least 2 feet of water. It will require no more attention until time for seeding in spring.

For the outdoor storage of a large quantity of seed a covered concrete vat can be more economically used than a number of separate containers. It may be built upon a firm foundation at the bottom of a stream or constructed in an excavation on low land conveniently located near a stream. If an excavation is made, it must be connected

with a stream by a ditch, in order that water may be obtained for the complete and continuous submergence of the vat. Good facilities for drainage must be provided. The vat should be low and broad, with capped manholes in the top and sufficient screened openings in the sides to permit a free circulation of water.

SHIPPING SEED AND PLANTS.

In the handling of wild-rice seed from harvest until seeding time special care must be taken to protect its vitality. The seed has been shipped in a dry state during the first two weeks after harvest with very small loss in vitality when packed in dry instead of moist sphagnum moss. For late fall, winter, and spring deliveries, however, the seed must be transported in the wet state, either in vessels containing water or in moist sphagnum moss loosely wrapped. Unless sown at once, the seed should be removed and put in vessels containing fresh water and placed in cold storage or outdoors where the proper moisture and temperature conditions can be maintained.

If the young plants are to be shipped, they should be spread out thinly on layers of moist sphagnum moss, between which they should be rolled rather tightly and then wrapped with heavy paper and securely tied. The young plants will remain fresh for three to five days in packages prepared in this way and may be safely carried by parcel post or express for a distance of 1,500 miles. Specimens have been transported in this manner from the Arlington Experimental Farm, Va., to Crowley, La., with success. The plants should be removed from the package as soon as received and transplanted at once.

USES OF WILD RICE.

Wild rice has two principal uses, namely, as food for birds and as food for man. It also has forage value.

USE AS FOOD FOR BIRDS.

Wild-rice seed is one of the principal autumn foods of the ducks that feed in the extensive marshes of the eastern United States. According to the records of the Bureau of Biological Survey, the mallard appears to be a large consumer of this grain. Besides this species, 11 other wild ducks are known to eat the seed of wild rice. They obtain it mainly in shallow water where the matured seeds have fallen into the soft mud. Young shoots and germinating seeds of wild rice are often eaten by many species of ducks, and the wood duck even feeds on the flowers. The stems and leaves of the mature plants are eaten by wild geese.

The wild-rice marshes of the Atlantic Coastal Plain also furnish shelter and food to the bobolink, which is called the reedbird when it begins its journey southward in late summer. At the beginning of the flight toward their winter home these birds congregate in almost

countless numbers along the watercourses where this aquatic grass grows. Here they feed upon the ripening as well as the mature seed of the wild-rice plant. The sora, or Carolina rail, is another marsh-loving bird which feeds at low tide upon the fruit of this plant, eating the fallen seeds that lie upon the mud or partly buried in it.

USE AS FOOD FOR MAN.

The Indians of the upper Mississippi Valley were using the seed of wild rice for food when that region was first explored by Europeans. Among certain tribes it is one of the principal articles of diet to this day. The earlier settlers, traders, and hunters recognized the food value of this seed and ate it, especially on their hunting and fishing expeditions. The grain is considered by many a great delicacy and is frequently served in the best hotels and restaurants with game. It is nutritious and very palatable and probably would be more generally used if its food qualities were better known. The grain after being parched is used by the Indians in soups or stews. It makes a very attractive dish when boiled and served as a vegetable with meat. It could readily take the place of potatoes and cultivated rice in our dietary. The quantity of grain that is available for the general trade, however, is never large, because the Indians who gather it sell only what they do not need for their own use. This surplus always is small and in consequence the price is high, which does not contribute to its popularity.

POSSIBLE FORAGE VALUE.

Besides producing a good grain, the wild-rice plant also furnishes an excellent feed. However, it is not a forage grass in the ordinary meaning of the term, but the young plant is quite succulent and is very much liked by stock. When it is accessible, as it is on the tidal lands at low tide, this grass often is cut before the flowering stems appear and is then fed to cows and horses. In composition it compares favorably with many grasses that are used in the same way, but of course can not compete with other wild species that require less water for their growth. Under certain low-land conditions where drainage can be controlled, it may be used as a supplemental forage crop.

ORNAMENTAL VALUE.

The natural beauty of the broad-leaved species of this wild plant should appeal to the landscape gardener. During its vegetative growth, and particularly while in flower, wild rice offers possibilities for effective decoration wherever water is used in ponds and small lakes to beautify public parks. Other ornamental uses are likely to be found for it by the resourceful gardener.

